# Not open and shut: India's gigafactory ambitions have three doors to get through

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Source: The Ken- https://the-ken.com/story/indias-gigafactory-ambitions/

Date: Nov 13, 2019

*The Indian government is on the cusp of announcing an ambitious plan to put India firmly on the global gigafactory map by 2024. But lacking key raw material, tech, and equipment, India will struggle to climb the ranks of Asia's most powerful economies.*

*India's imports of lithium-ion batteries swelled 6X to $1.2 billion between 2015-18. China, which has three gigafactories, supplies over 90% of this*

*Niti Aayog's draft plan, full of tax breaks and subsidies, aims to generate 50 GWh power from lithium-ion cell production by 2024*

*But there are no takers. Panasonic's on the fence and LG Chem has already scaled back investment plans*

*India's refusal to join the RCEP trade pact has left it to chart a lonely path to lithium-ion self sufficiency.*

Elon Musk, CEO of auto major Tesla, believes that 100 gigafactories could sustainably power the whole world through a new, ascending global currency. Lithium.

Musk might be the visionary here, but it's the Chinese who've captured the lithium zeitgeist.

Hitting its stride a decade earlier than India, China not only strategically stockpiled a supply of essential minerals but also laid out elaborate subsidies to completely localise the ore-to-battery supply chain. This was helped by a wafer-thin wall between the private sector and the state.

Today, the country is home to three of the world's largest gigafactories. Each plant, roughly the size of 100 football fields, generates one gigawatt (GW)—or 1,000 megawatts (MW)—worth of lithium-ion batteries.

Tesla's Gigafactory 3 in Shanghai, China's fourth, is now ready to begin production.

Tesla's hardly the only one powering the shift to lithium. Battery-makers like Korea's LG Chem, China's BYD and CATL, as well as Japan's Panasonic are doubling down on lithium-ion battery production to capture the world's largest electric vehicle (EV) market in China.

With a mission to electrify 30% of its vehicles by 2025, what share does India have of this global, lucrative and largely Asian manufacturing pie?

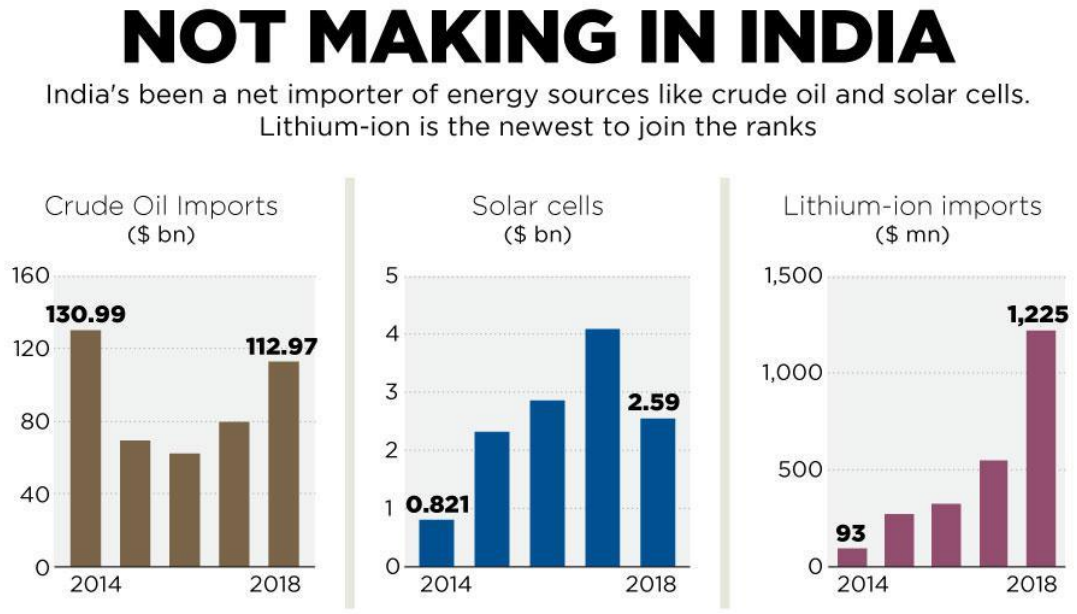
## Currently, zero.

India's stamp on the global lithium-ion value chain has been negligible so far. Even with a marginal slow down in the sale of EVs in China in 2019, the country still leads India's EV sales total by 400,000.

However, a new plan is in the wings.

Niti Aayog, the Indian government's policy think tank and self-appointed EV cheerleader, is getting involved. It has rounded up a high-powered working group to plan and execute the National Mission for Transformative Mobility and Battery Storage. The goal? To launch 4-5 gigafactories in India to ensure a constant supply of lithium-ion cells and battery packs for EVs and energy storage by 2024. Each factory will have a capacity of 10 GW—enough to power 40,000 electric buses—ramping up production capacity to 50 GW by 2024.

The think tank aims to put India on the expanding global gigafactory map. Lowering the country's dependence on China is next on the list—between 2015 and 2018, India's imports of lithium-ion cells swelled 6X to $1.2 billion. China accounted for nearly 90% of this.




With China monopolising most of the value chain, India's had an embarrassingly late start in this global race. It took Niti Aayog more than six months to cobble a draft plan together. Tesla took less time to set up its Gigafactory 3.

The think tank is confident that the draft plan will have global battery majors lining up. It has even changed its tendering system, with plans to hand them out by April 2020. "The scheme will be finalised anytime now," says an official in charge of drafting the plan.

There's just one problem.

"Raw material supply is a huge challenge, even if we decide to manufacture li-ion batteries in India. Most of our raw material is purchased in China or Japan. Without demand, we can't force our suppliers to set up shop in India. We haven't made any arrangements to bring raw material into the country. The shift from China won't happen anytime soon"

## Panasonic Executive

All the global companies that Niti Aayog is counting on to submit tenders—Panasonic, BYD, LG Chem, Tesla—and even local manufacturers like Exicom, Exide and Amararaja, have done little more than put their foot in the door.

"Without solid demand, we don't see any real reason to shift manufacturing from China to India," says a Panasonic official from their Gurugram office, who wished not to be identified. (Panasonic sent us a detailed statement* subsequent to publishing of the story, denying the statements by the unnamed official).

Niti Aayog's own estimates indicate that of the 50 GW capacity planned, nearly 60% will come from EVs. Demand, however, has remained largely stagnant. Despite subsidies, just 56,000 were sold in 2018. Panasonic knocked on several government doors over the last five years, only to have its enthusiasm dampened. Industry heads who were privy to discussions say negotiations always fell through whenever demand was discussed.

LG Chem decided it didn't want to go through said door. A plant with a 10 GW capacity will need around $1-2 billion to set up, according to the government. Instead of investing that much, LG cut its losses early and settled for a battery assembly plant in Maharashtra in partnership with local automaker Mahindra.

## Not an ideal start.

To earn a spot amongst Asia's powerful, India needs to prove that it has the manufacturing capability and technical knowledge to capture a large portion of the global EV value chain. But poor uptake, a lack of local lithium ore reserves, and the cost of setting up "clean rooms" for cell production have turned the game into a risky, high stakes one. With a much lower grasp of the supply chain locally, it could potentially halve the subsidies for manufacturers.

Especially now, after India's refusal to join the Regional Comprehensive Economic Partnership (RCEP), a trade pact between Asia's largest economies that would've allowed it to integrate better with global value chains.

India is now charting a long, lonely path to lithium-ion self sufficiency. But there are three choices it must face, before that can happen. And how India chooses will determine its electric future.

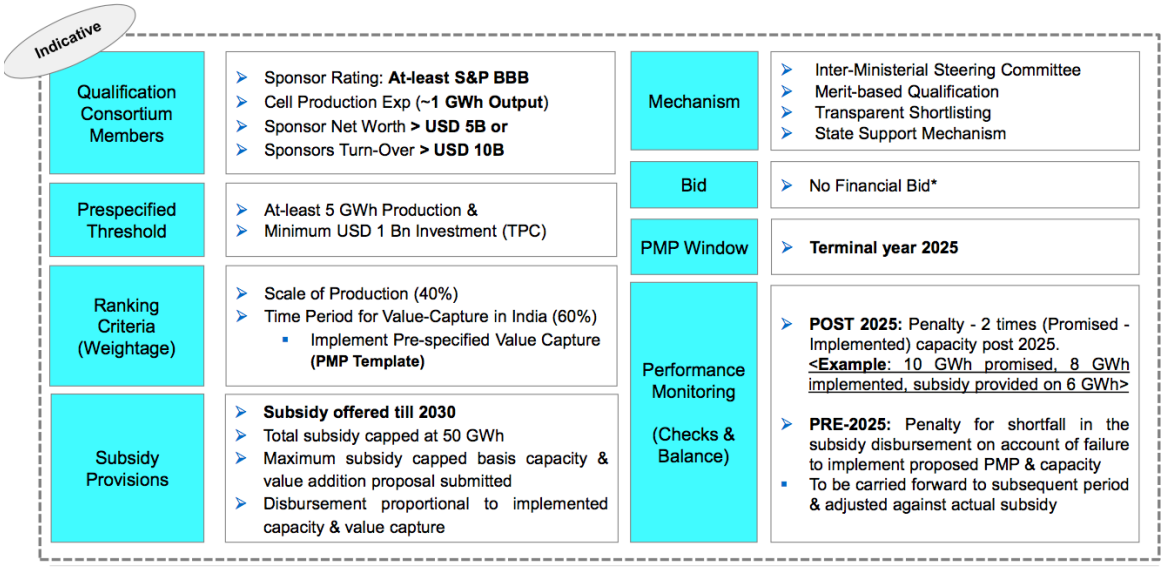
## Behind door 1: Demand or Supply?

In its draft plan that XXXX accessed, Niti Aayog believes it has created a sumptuous incentive buffet to pull India along this path: a 3% interest rate subvention on money borrowed in Indian rupees, a 10-year corporate tax refund, and an upto $35 dollar subsidy per KWh (kilowatt per hour) on the price of the final battery.

The crown jewel of this plan, says a Niti Aayog official, is to cumulatively level the cost of production for these companies, vis-à-vis a country like China, where raw materials, trained manpower and manufacturing equipment are in abundant supply. "Otherwise, there's little chance that these companies can fight it out in the open market," says the official.

If one were to read between the lines, the subsidy plan aims to stem the flow of Chinese li-ion cells in the Indian market. According to information sourced by XXXX, these currently retail between $105-135 per KWh in India. The costs for making these cells locally, as per manufacturers' estimates, will at least be 15-20% more than the cost of production in China. The draft policy also scraps the standard lowest-bidder-wins tendering system. Instead, there is a focus on evaluating bidders on minimum thresholds: achieving a scale of 40% manufacturing capacity by 2023, a plan to invest a minimum of $150 million per project and build minimum capacity to generate 5 GWh.

## TRANSPARENT SHORTLISTING & DISBURSEMENT PROCESS*




But who's ready to dip into this subsidy candy jar?

"It's a funny situation. The government has laid out an elaborate incentive structure, but no one's beating down their door to claim it," says a senior executive of a Gurugram-based energy company, on the condition of anonymity.

It all boils down, he claims, to an anaemic growth in demand for electric vehicles or battery storage capacity.

Despite the small market for EVs, and even smaller market for battery storage, Niti Aayog's most conservative estimate is that India would need to generate 50 GW worth of lithium-ion cells by 2024. This is a huge leap, considering that there is no cell production in India currently. The GWh that is currently produced in the country comes from the few battery pack assemblers now starting to set up shop.

To them, the math is simple—4-5 giga plants of 10 GW capacity each.

Short term demand projections, says Stefan Louis, don't justify a 10 GW production capacity. Its simply too large a bite for India's demand appetite, which is closer to 0.5 GW currently. Louis heads Nexcharge, a joint venture between Swiss energy company Leclanche and Indian battery manufacturer Exide. Nexcharge plans to set up a cell production facility by 2022, but Louis is worried that with a 0.5 GWh capacity, economies of scale are unlikely to kick-in quickly. "If we did invest in a large scale 10 GW plant, without the requisite demand, we'd be running a high speed line over a short period of time to fulfil the demand, which could lead to relatively high amounts of production scrap," says Louis.

## Early concessions

Niti Aayog's plans has already scaled back some of its eligibility criteria for potential investors. Initial drafts required total net worth of applicants to be at least $5 billion. This has been brought down to $500,000. The ticket size of each investment was also reduced and subsidies on production were increased from 30% to 35%

Demand has been a thorn in the government's side ever since it launched demand-side incentives under the Faster Adoption and Manufacturing of Electric Vehicles in India-I scheme (FAME-I). Under FAME-II, the government rejigged the subsidy structure and introduced import duties on core battery parts (XXXX has written about this previously). The intention was to spur both demand and supply of EVs. But it ended up subsidising only premium electric vehicles (like Ather's scooters), say two industry experts XXXX spoke with.

Despite li-ion cells having a range of applications beyond EVs, Niti Aayog has pegged transportation as their largest use case— chiefly because of their dependence on schemes like FAME-II to drive demand. This might as well be the weakest cog in this multi-billion dollar effort.

"We haven't been able to sign a single contract with a local EV manufacturer who can assure a demand for lithium-ion cells," says the Gurugram-based executive quoted above. The company the executive works for has dropped its investment plans for now, citing demand of barely 100-200 MW (megawatt).

Niti Aayog agrees it's a concern. "But these are unprecedented incentives and there are enough signals in the policy that demand can be generated," says a member of the think tank confidently.

**KEY POINTS (Demand Creation)**

| S.No | Recommendation |
|---|---|
| 8 | Firm National Target/ Vision for Electric Vehicles by 2030 |
| 9 | Focus on Frequency Management (fixed band) for Network Stabilisation |
| 10 | Demand Aggregation (***Economy of Scale***) of E-Buses / E-Cabs / E-Autos/ backed with MoUs/ Firm-Contract with State Transport Units (STUs)/ Cab Aggregators & Operators |
| 11 | Demand Aggregation along with linkage to FAME-II/AMRUT Scheme for Cab Aggregators & Fleet service Providers |
| 12 | Guidelines for Standardisation of Charging Infrastructure and Battery Swapping in India for Electric Vehicles |

A slide from Niti Aayog's draft plan on demand measures the government is banking on, shared with stakeholders in May 2019

Contrary to what the government believes, demand clearly trumps subsidies for global players like Panasonic. While the company has publicly thrown its hat into the ring, the Panasonic executive says that there has been little intention internally to move into manufacturing immediately.

This runs counter to the government's best-laid plans, which intend to award tenders—by April 2020 at the latest—and achieve a fully-local value chain by 2024.

## Behind door 2: Complex chemistries

While this demand-supply issue is a macro problem, the policy falters even at the cellular level.

The heart of a lithium-ion cell is the cathode, usually a complex mix of minerals like nickel, manganese, cobalt and phosphorous. The combination of these chemicals used determines the life-cycle, safety and range of a battery.

There's still no last word on what constitutes an ideal lithium-ion battery. Its chemistry is critical for India's mass adoption of EVs.

Currently, the most widely used is the nickel-manganese-cobalt, or NMC, combination. In fact, as one Hyderabad-based battery expert points out, the Indian market is still using NMC 145, a first generation battery. He wished to comment anonymously as he consults various battery manufacturers.

NMCs are widely used in China, but their pace of research and development on li-ion cells means constant improvement in specifications. At $135 a piece, Chinese NMCs are cheaper than other battery types, but aren't the best option when it comes to India, as road temperatures are 10 degree celsius higher than China. NMCs aren't stable at higher temperatures of 45-55 degrees. They are especially unsuited to 2- and 3-wheelers, which don't have elaborate cooling mechanisms.

## Space dust

In 2018, the Indian Space Research Organisation (ISRO) chose 10 organisations—Thermax, Exicom and Amararaja included—to do a tech transfer. ISRO uses li-ion cells to power the launch of its satellites. Except, as experts point out, this battery chemistry is outdated. In addition, it's only suited to colder temperatures, which won't work in India's heated road conditions.

And despite repeated claims of being agnostic about the type of chemistry used, the Indian government has a soft spot for NMCs. "Output-linked subsidies" in the plan are connected to the energy density and life-cycle performance of a battery.

Battery manufacturers who've seen the draft plan are uncomfortable with this. "The government should not embed these technical requirements in the policy. India's transport needs are unique. Simply copying what other countries chose isn't going to work," says the representative of an international energy company, now laying down roots in western India. Having worked in the Indian

energy space for over two years, this official claims that the government wants to adopt the latest tech, without first ensuring that it's a fit for the Indian EVs.

The Indian Institute of Technology in Madras (IIT-M) has also been batting for NMCs. But like the India Energy Storage Alliance (IESA) have recommended that the draft plan look beyond them, to the other 15-16 types of chemistries available.

"There was an interim proposal bias on NMC. We wanted to have that changed. We've now been told that over 15 battery types will be accepted by the plan".

A competing chemistry, says the expert mentioned above, is Lithium-ion Phosphate or LFP. Experts say LFPs might be a better bet as they are heavier than NMCs by 3-4 kgs on average and are safer to use in high temperatures. "That's the main reason LFPs are used in buses and not by 2 and 3-wheeler makers," says the battery expert.

A network of government labs, like Bhabha Atomic Research Centre and Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), have been experimenting with alternate chemistries like sodium-ion, to reduce dependence on costly lithium, nickel and cobalt imports. These are, however, miles behind NMC in terms of market readiness.

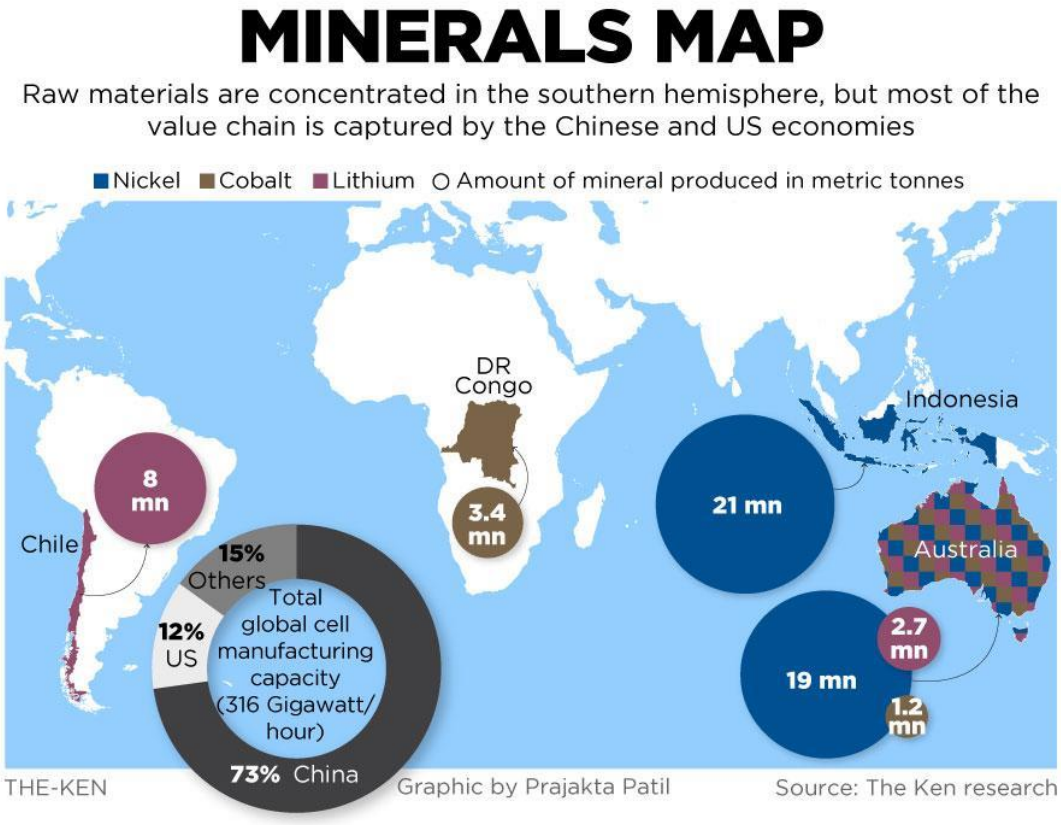
## Behind door 3: How much to "Make in India"?

If alternate chemistries are still in the R&D stage, li-ion batteries, with its known technologies, might make an easier case for production in India—especially under the government's 'Make in India' initiative.

That's not the case though.

Unlike a noisy and messy lead acid battery plant, the li-ion assembly line is housed within a sanitised "clean room", where water condenses at minus 70 degree celsius. A good one resembles a hospital's intensive care unit (ICU). These conditions, says Saptarishi Ghosh, head of research at Exide, must be maintained across the plant, which could cost anywhere between Rs 1200-1500 crore ($168-$210 million). India lacks both the high-tech equipment used to coat and bake these batteries, and the requisite talent to supervise the process.

The other, bigger issue here is that an ore-to-battery plant simply isn't possible without unmitigated access to lithium. China capitalised on this almost a decade ago, creating a dedicated supply chain for their domestic and export industry from mines in Chile and Bolivia. In 2018, a Chinese company called Tianqui Lithium paid $4 billion to gain control over 50% of the world's lithium production. China has a strong grip on cobalt too—it has long-term agreements with the Democratic Republic of Congo, rich in cobalt reserves, and now controls over 85% of the global supply of the mineral.




In comparison, India's efforts are stark. It only recently joined the race for these "strategic minerals" through KABIL—a Ministry of Mines initiative to lock in supply for lithium oxide from Bolivia. "Even if we set up a raw material supply, it's difficult to beat the global learning curve on optimisation," says the Gurugram-based energy executive mentioned above. Countries like China have spent over a decade fully optimising the process of cell production. It's almost impossible for Indian firms to catch up.

The straw that breaks this camel's back could very well be Niti Aayog's own draft policy.

Without access to raw material or sophisticated equipment, companies may only capture 50-60% of the battery value in India. But incentives are linked to a 100% local-value capture, meaning the higher the production processes in India, the more subsidy a manufacturer can avail.

Consequently, the $35 subsidy on the cell could be whittled down to as little as $15. That too in the best-case scenario.

Sunrise, sunset

India's solar power generation capacity went from 2000 MW to almost 28 GW between 2014 and 2019. India even met its solar power generation targets four years in advance. The growth, however,

is buoyed by 90% imports of PV cells and wafers from China, with India entering the solar cells supply chain only at assembly. The li-ion batteries situation seems like a repeat of that.

In light of this, even the most comprehensive rescue mission might struggle to move India up the value chain. And the Indian government, still clearly spooked by consequences of its own inaction on solar photovoltaic cells and semiconductors, does not want a Chinese tsunami to wipe out India's nascent attempts at lithium-ion cell production. "We believe battery assembly is an industry that's already taken off. There's no need to incentivise that," says the Aayog official mentioned above.

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But there's a silver lining here, Rahul Tongia, a researcher at economic think-tank Brookings India, points out. Instead of manufacturing the cell—a train Tongia thinks India has missed—Indian and global companies should shift their goalposts. "If you double down on battery assembly, the low hanging fruit, you can always make cells as you scale," says Tongia.

In addition to less risk, India also has the opportunity to adopt a global commodity for local usage—customisation. He points to the e-rickshaw example, a use case specific to India, and says that the 'Make in India' needle can be threaded in different ways.

"Battery modules used in India need to have a higher temperature resistance, or a better power-to-energy ratio," he says. Such customisation isn't possible at global levels. But for India, it could be the secret sauce the country needs. The next few years are critical for India's lithium zeitgeist.

*In a statement sent after the story was published, Panasonic disavowed the statements made by the company executives quoted in the story. It claims the program under consideration is not about shifting any manufacturing from another country but establishing a gigafactory instead. While it acknowledges that it is considering many aspects of this approach, including demand, it says its engagements on this subject with the government have been positive.